

WHAT IS CLAIMED IS:

1. A microdispersion treatment device for treating materials comprising:  
at least one emitter coupled to at least one power supply for producing an energetic emission;  
an exposure region designed to allow the emission to pass therethrough; and  
a droplet formation device designed to deliver a microdispersion of droplets of a liquid solution of material to the exposure region such that the droplets pass through the exposure region and the material is substantially non-destructively exposed to the energetic emission.
2. A microdispersion treatment device as described in claim 1, wherein the droplet formation device comprises at least one needle.
3. A microdispersion treatment device as described in claim 2, wherein the needle has a gauge between about 14 and 30.
4. A microdispersion treatment device as described in claim 1, wherein the droplets are less than about 3 mm in diameter.
5. A microdispersion treatment device as described in claim 1, further comprising at least one gas nozzle arranged within the exposure region and designed to produce a flow of gas along the walls of the exposure region such that droplets are urged away from the walls of the exposure region by the gas flow.
6. A microdispersion treatment device as described in claim 5, wherein the gas is a chemically inert gas.
7. A microdispersion treatment device as described in claim 5, wherein the gas is selected from the group consisting of: a noble gas and nitrogen.
8. A microdispersion treatment device as described in claim 1, further comprising a flow controller arranged within the exposure region and designed such that the residence time of the droplets in the exposure region can be controlled.

1

9. A microdispersion treatment device as described in claim 8, wherein the flow controller is gas nozzle design to direct a flow of gas at the droplets such that the residence time of the droplets depends on the speed of the flow of gas.

5

10. A microdispersion treatment device as described in claim 9, wherein the gas nozzle is designed to increase the residence time of the droplets.

10

11. A microdispersion treatment device as described in claim 9, wherein the gas nozzle is designed to decrease the residence time of the droplets.

12. A microdispersion treatment device as described in claim 9, wherein the gas is a chemically inert gas.

15

13. A microdispersion treatment device as described in claim 9, wherein the gas is selected from the group consisting of: a noble gas and nitrogen.

20

14. A microdispersion treatment device as described in claim 8, wherein the flow controller is a pair of charged plates designed to create a charged field within the exposure region such that the residence time of the droplets within the exposure region depends on the properties of the charged field.

25

15. A microdispersion treatment device as described in claim 14, wherein the charged plates are designed to increase the residence time of the droplets.

16. A microdispersion treatment device as described in claim 14, wherein the charged plates are designed to decrease the residence time of the droplets.

30

17. A microdispersion treatment device as described in claim 1, wherein the at least one emitter is at least one flash lamp.

18. A microdispersion treatment device as described in claim 17, wherein the at least one flashlamp is designed to emit a pulse of broad-spectrum light.

35

1

19. A microdispersion treatment device as described in claim 17, wherein the at least one flashlamp emits an emission having wavelengths in the visible and ultraviolet spectrum.

5

20. A microdispersion treatment device as described in claim 17, wherein the at least one flashlamp emits an emission having a spectrum including wavelengths of at least about 170 to about 2,600nm.

10

21. A microdispersion treatment device as described in claim 17, wherein the at least one flashlamp emits emission pulses of duration between about 0.001 and about 100ms.

15

22. A microdispersion treatment device as described in claim 17, wherein the at least one flashlamp emits an emission having an intensity between about 0.01 and about 50J/cm<sup>2</sup>.

20

23. A microdispersion treatment device as described in claim 17, comprising at least two flashlamps.

24. A microdispersion treatment device as described in claim 23, wherein the at least two flashlamps emit sequentially.

25

25. A microdispersion treatment device as described in claim 23, wherein the at least two flashlamps emit simultaneously.

26. A microdispersion treatment device as described in claim 1, wherein the emitter is a gamma ray emitter.

30

27. A microdispersion treatment device as described in claim 1, further comprising a collection chamber positioned at the outlet of the exposure region to collect the droplets.

35

28. A microdispersion treatment device as described in claim 27, wherein the surface of the collection chamber has a low surface energy coating.

29. A microdispersion treatment device as described in claim 28, wherein the low surface energy coating is selected from the group consisting of: teflon, polycarbonate and polypropylene.

30. A microdispersion treatment device as described in either claim 5 or 9, further comprising a flow gas filter arranged and designed to remove the gas flow from the exposure region.

31. A microdispersion treatment device as described in claim 1, further comprising a temperature controller arranged to maintain a constant temperature within the exposure region.

32. A microdispersion treatment device as described in claim 1, wherein the material is selected from the group consisting of: proteins, and pharmaceuticals.

33. A microdispersion treatment device as described in claim 1, wherein the droplet formation device is designed to produce a microdispersion of substantially uniform droplets.

34. A microdispersion treatment device as described in claim 1, wherein the droplet formation device is designed to produce a microdispersion of substantially uniform droplets at a substantially uniform rate.

35. A microdispersion treatment device for treating materials comprising: at least one emitter coupled to at least one power supply for producing an energetic emission; and

a treatment chamber defining an internal volume having an exposure region designed to allow the emission to pass therethrough, the treatment chamber further comprising an inlet in fluid communication with a reservoir of a liquid solution of material arranged on a first side of the exposure region designed to emit a microdispersion of droplets of the material and an outlet arranged on a second side of the exposure region designed to collect the droplets, such that the droplets pass

through the exposure region and such that the material is substantially non-destructively exposed to the energetic emission.

36. A microdispersion treatment device for treating materials comprising:  
at least one emitter coupled to at least one power supply for producing an energetic emission;

a treatment chamber defining an internal volume having an exposure region designed to allow the emission to pass therethrough, the treatment chamber further comprising an inlet in fluid communication with a reservoir of a liquid solution of material arranged on a first side of the exposure region designed to emit a microdispersion of droplets of the material and an outlet arranged on a second side of the exposure region designed to collect the droplets, such that the droplets pass through the exposure region and such that the material is substantially non-destructively exposed to the energetic emission;

a flow controller arranged within the treatment chamber and designed such that the residence time of the droplets in the treatment chamber can be controlled; and

at least one gas nozzle arranged within the internal volume designed to produce a flow of gas along the walls of the treatment chamber such that droplets are urged away from the walls of the treatment chamber by the gas flow.

37. A method of treating a material comprising:  
providing a source of energetic emission;  
providing a liquid solution of material;  
separating the solution of material into droplets and exposing the droplets to the energetic emission.

38. A method of treating a liquid material comprising running a solution of material through the microdispersion treatment device as described in claim 1.